Men eat on Mars, Women on Venus? An Empirical Study of Food-Images

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ABSTRACT

Food is central to all human beings and in modern society it is also used to sustain identity. In this work we present a quantitative approach for exploring gender-differences in the context of food using a large set of user-generated food pictures from Flickr and discuss factors that may potentially explain those differences. Our results indeed show that for certain types of food clear gender-specific differences exist. However, we find that only certain parts of them can be explained by gender-specific differences in the food consumption behavior, while other parts can be better explained by the media portrayal of food consumption.

1. INTRODUCTION

Culinary preferences contribute significantly to the sense of ourself [13]. For example, the vegan and the gourmet make statements about themselves through their culinary practice. While gender, race, sexuality and ethnicity describe our "major identity", preferences in music, style and food define our "minor identity". By sharing content on social media, users actively create online identity and promote their public self-images. While scholars have explored how identity and language are manifested in online interactions [2, 3, 6, 7, 19], it remains unclear to what extent major identity such as gender manifests on image sharing platforms.

In this work we investigate to what extent food pictures uploaded by users reflect one specific part of their major identities, namely their gender, and which factors may explain why they do or do not do so. We focus on food pictures since (1) the sharing of food pictures is a huge trend nowadays[1] and (2) food is often used to mark membership of a group and create identify [4].

This work sets out to investigate gender which is part of our major identity and how it effects the way we define our minor identity online by exploring a large set of user-generated geo-tagged food pictures. Concretely, we tackle the following research questions:

- Do gender-specific differences exist in the type of food men and women upload? How stable are those differences over time?
- What are the factors driving gender-specific differences in the food picture uploading behavior?

To address the second research question we explore two potential explanations: food consumption and gender portrayals of food consumption in the media (e.g. for advertisements). *Cultivation theory* predicts that media's portrayal of the world affects people's beliefs about reality and consequently may impact their behavior [21, 18]. Therefore, food-specific gender roles that are propagated in the media (see e.g. Figure 1) may impact both, the self-image people want to promote and what they actually consume. Further, what people consume might also explain to some extent the type of public self-image they create and/or might impact the development of targeted campaigns in the media which are informed by consumer marketing. This indicates that the two explanations which we investigate are most likely not independent. In this work we do not aim to disentangle these explanations, but present preliminary results on the comparison of them and discuss to what extent they explain what we observe in the photo upload behaviour.

Figure 1: Top web image search results for the queries *a)* "eating meat" and *b)* "eating sweets". Gender stereotypes clearly emerge.

2. FOOD IMAGE UPLOAD BEHAVIOR

In the following we explore gender-specific differences in the type of food men and women upload.

2.1 Data Collection

[1] http://www.bu.edu/bhr/files/2014/05/BHR_v2_2-greenfield.pdf

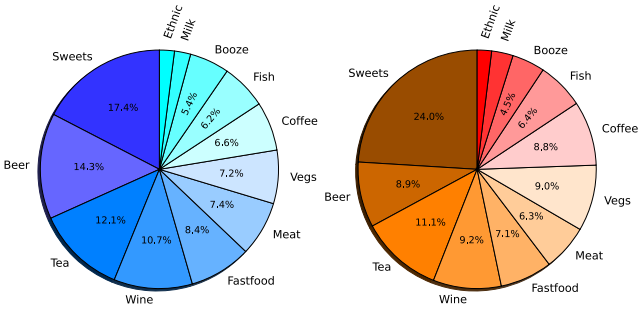


Figure 2: Distribution of interest over food categories.

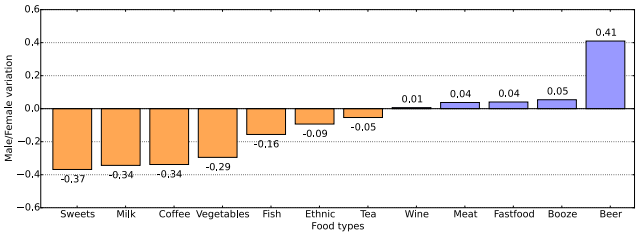


Figure 3: Ratio between the proportion of men and women who uploaded at least one picture that corresponds to that type of food (normalization with total number of users).

(a) Men (b) Women

Figure 4: The most frequently used tags of men and women in our dataset.

To be able to differentiate different types of food and drinks, we used a list of basic food vocabulary that is used for teaching English[2] as a starting point. This list contains important food words which can be grouped into nine macro-categories: *meat*, *fish*, *fruit&vegetables* ("vegetables" for brevity), *milk&diaries* ("milk" for brevity), *sweets*, *ethnic food* (e.g., "indian food"), *fast food* (e.g., "cheeseburger"), *alcoholic drinks*, *coffee&tea*. In the following we will refer to these categories and, from time to time to some of their subcategories (e.g., decomposition of alcoholic drinks into beer, wine, and booze). We make the full list of words for each category publicly available[3]. We then collected a random sample of nearly 15M Flickr images taken by around 1M users between 2005 and 2014 labeled with at least one tag in our list and whose uploaders specified their gender in their public profile. All data have been anonymized and processed in aggregate. 41% of the users in our sample are female. The users in our sample are quite active in terms of number of uploads; the mean number of pictures per user is 200, the average over 1000.

2.2 Food Popularity

Since we aim to identify gender-specific differences in the popularity among different food categories, we first compare how the interest of women (or men) in food is distributed across our food categories. We use the number of women (or men) who uploaded at least one picture that corresponds to the food category as a proxy for the male (or female) interest in that food category. Using the number of pictures would certainly be an alternative; however, this method would be very prone to super-users (e.g. professional photographers), who upload much more pictures than most users. Figure 2 shows that the distribution of interest over food categories looks pretty similar for men and women at the first glance.

However, interesting differences become visible when comparing the ratio between the proportion of men and women that uploaded pictures of the same food category (cf. Figure 3). For example, 24% of all men uploaded at least one picture of beer at some point, while 17% of women did the same. This leads to a men-women ratio of 1.41 which means that beer is 41% more popular among male users than female users. Figure 3 shows that the most "male food or drink" is beer, followed by booze, fast food and meat, while the most "female food or drink" are sweets, milk, coffee, vegetables/salad and fish.

Figure 4 shows the tags which are most frequently used by men and women. Again one can see that e.g. sweets are more popular among female users. To further explore which tags are most indicative for men and women we train a Naive Bayes classifier. We use the classifier to determine which terms are most effective for distinguishing the gender of the user who uploaded and tagged the picture. Using likelihood ratios for comparing different feature-outcome relationships, we find that the most discriminative food-related tags are the following: "cupcakes take the cake" (female:male ratio = 7.9 : 1.0), "buttercream" (female:male ratio = 7.7 : 1.0), "cupcackes" (female:male ratio = 4.8 : 1.0), "baked goods" (female:male ratio = 4.8 : 1.0) and "muffins" (female:male ratio = 4.2 : 1.0). This confirms our intuition that especially sweets are more likely to be uploaded by women and are therefore indicative for women.

2.3 Temporal Trends in Gender Differences

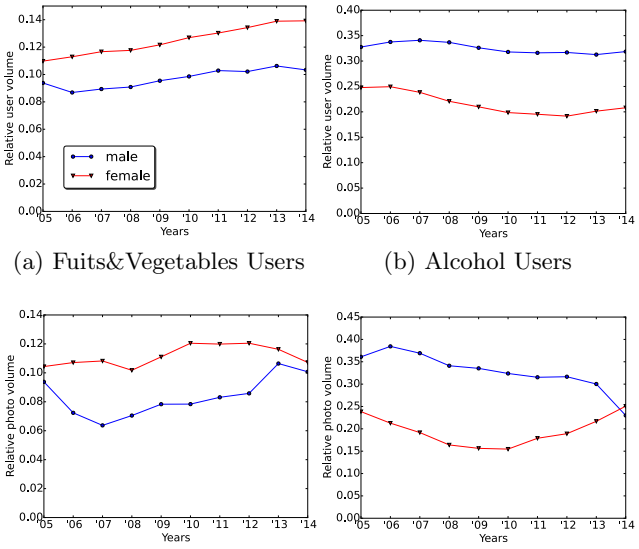
Self selection bias prevents us from making statistical inference for single points in time. In addition, potential changes in the composition of the population of the online community over time prevent us from using time series to make statistical inference about changes over time. However, if changes in the composition of the online community members are consistent across genders, then the comparison of relative changes for men and women can be used to provide information about trends (e.g., does the popularity of meat increase more for men than for women?)

Figure 5 shows two examples of how gender-specific food trends change over time[4]. One can see that the popularity of

[2] http://usefulenglish.ru/vocabulary/food-main-list

[3] https://www.dropbox.com/s/g07pimq500x1xoq/dictionary.xlsx?dl=0

[4] Note for all other food categories the proportions remain



(a) Fuits&Vegetables Users (b) Alcohol Users

(c) Fuits&Vegetables Photos (d) Alcohol Photos

Figure 5: Relative volume of users (top) and photos (bottom) for vegetables and alcohol.

vegetables is increasing for men and women (i.e., more male and female users upload more pictures about vegetables), but for women the increase is slightly stronger, indicating that vegetables will stay a rather female food category. Despite that, the difference between men and women in the relative volume of photos depicting vegetables has diminished during the years.

Further, we can see that the number of users who upload pictures of alcohol, which is more popular among men according to our aggregated analysis, is decreasing for both genders. However, the number of pictures about alcohol in the female population is increasing, while it is decreasing in the male population. This indicates that the male population of alcohol drinkers seems to lose interest in posting alcohol pictures over time, while the female population gains interest in it. A more fine-grained analysis of different types of alcohol (beer, wine and booze) showed that beer is going down for both genders (which was also reported in a recent Gallup survey [9]), while wine and booze becomes more popular among the female population that uploads alcohol pictures.

3. EXPLAINING GENDER-DIFFERENCES

Next, we discuss two plausible explanations for the gender-differences in the food image uploading behavior of men and women: differences in the food consumption and media portrayals of food and gender.

3.1 Food Consumption

The Economic Research Service (ERS) of the US Department of Agriculture has combined 1999-2000 and 2001-2002 data from the National Health and Nutrition Examination Survey (NHANES) to report commodity consumption by household income, age and gender, body weight status, race and ethnicity, and education attainment as well as by the location where foods were eaten [15]. They collect this data from a representative sample of the US population and report the relative consumption patterns of men and women for major food categories (grain, fruits, vegetables, fats and oils, eggs, milk and dairies, meat). Not surprisingly men have a higher retail weight for most types of food, but for some types of food like meat the difference is much higher than for all other types of food. One can see, for example, that the difference between men and women is most pronounced in the amount of meat they consume. For meat (pork and beef) the retail weight per person and per year is 75% higher for men than for women. Previous research also found that the male-meat and women-vegetable link is very well established amongst groups as diverse as Amazon Indians [11] and Western urbanism [14]. While in modern North American society, many men do not consider a meal to be "real" unless it contains meat [17], females express more disgust and negative attitudes toward eating meat than males [12]. Also the food image upload behavior indicates that meat is indeed more popular among men.

For fruits women have a higher retail weight per year (for citrus fruits 7%, for stone fruits 8% and for tropical fruit 9%). However, several exceptions exist such as Banana (men consume 16% more) or apples (men consume 11% more). For vegetable we observe a similar picture: overall the retail weight of vegetables for man per year is 22% higher than for woman. However, some vegetables such as Cauliflower, Broccoli, Carrots and string beans are more consumed by women. Also for salad the retail weight of woman per year is higher than it is for man (15% higher for cucumbers, 12% higher for Leafy Vegetables, 6% higher for lettuce).

The most female food in our image sample are sweets. While our consumption data do not contain sweets, previous studies about sweets consumptions suggest that in the US sweets are indeed more popular among women. Zellner et al. [22] report that 50% of American women craved chocolate, while only 20% of men reported doing so. However, the same study found that in Spain, men and women craved chocolate equally (about 25%), while in Egypt, neither sex craved chocolate, with both sexes showing a high preference for salty foods. This suggests that cultural factors may play a role as well.

Though the image uploading behavior of users suggest that diary products are more popular among women, the consumption data shows men consume 25% more diary products than women, exceptions are skim milk (4% increase for women) and yogurt (18% increase for women) which are more heavily consumed by women. Further, while the food consumption data suggest that the fish consumption is 29% higher among men, photo uploads suggests that fish is more popular among women.

These examples show that food consumption data may explain to a certain extent what type of food image are predominantly uploaded by men (or women). However, consumption data can certainly not explain everything. One needs to note that gender-specific food popularity is only one factor that determines what men and women consume (e.g., availability, costs, culture or health are examples of other factors). Further, popularity and preferences are clearly also impacted by the media who create desire and promote gender roles.

3.2 Media Portrayals

relatively stable over time

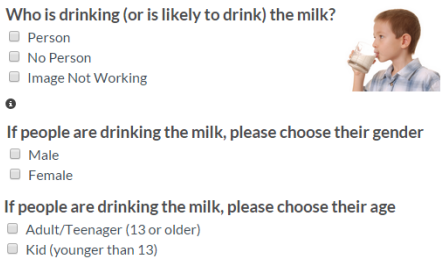


Figure 6: Example of one picture that was shown to the crowd worker and the questions that they had to answer.

In the following we set out to investigate the media portrayal of gender-roles in the consumption of food. To determine which food is mainly shown to be consumed by men or women in the media, we search for images on a web search engine using phrases like "eating X" or "drinking X". For example, figure 1 shows the top results for "eating meat" or "eating sweets". One can clearly see that according to the media sweets are more likely to be consumed by women, while meat is more likely to be consumed by men.

3.2.1 Data Collection

Using a web search engine, we downloaded the top 100 images for the consumption of different food items (e.g. "eating meat", "eating sweets"). For each image, crowd workers were asked to describe who is consuming X on the picture? The brief task description was "Look at an image and choose the best categories for an image that describe who is eating (or is likely to eat) the meat." Figure 6 shows an example of how the task looked like. We paid workers 5 cent for labeling 5 pictures. Workers were pretty satisfied with the task. We got an average rating of 4.3 (on a scale from 1 to 5, where 5 indicates the highest satisfaction).

3.2.2 Results

Figure 7 shows the proportion of men and women that are shown to consume certain types of food in the top 100 image results returned from web search for the queries "eating X" or "drinking X". We excluded kids (i.e., people which seem to be younger than 13) in this figure. However, our results did not change much when including kids. One can see from figure 7 that according to the media meat and beer are male food (beer is even more male than meat). This is in line with our results from the image uploading behavior of men and women.

Fastfood and milk are pretty gender-neutral, while tea, fruits, salad, sweets, coffee, vegetables, seafood, sushi and cake are more associated with women according to the media.[5] The most female foods in the photo sample we consider are sweets, milk, coffee, fruits&vegetables and fish. All of them are also according to the media more female.

The major difference between the gender-specific food-image uploading behavior and the media portrayal of food and drinks is that alcohol seems to be more popular among men according to our aggregated analysis however, is also frequently promoted with women. Partially this is because images of women drinking alcohol in the mass media (tv, advertisements) are sometimes sexualized and specifically

[5]The results for "eating fish" were almost identical to "eating seafood" and are therefore omitted to save space.

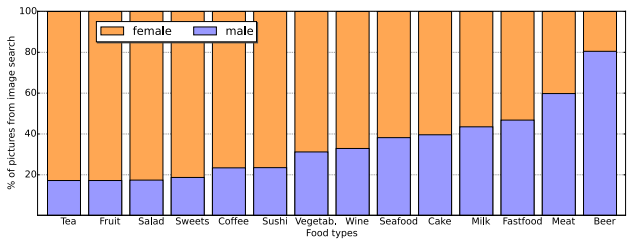


Figure 7: Proportion of men and women that are shown to consume certain type of food in the top 100 image results returned from web image search (out of those pictures which actually depict a person eating something). We excluded kids (i.e., people which seem to be younger than 13).

targeted to male consumers. However, our temporal analysis on the photo upload trends also shows that the interest in alcohol is increasing among the female users while it is decreasing among the male population. Maybe the media industry is already aware of this trend.

4. RELATED WORK

Previous research in computational social science started exploring the potential of user generated content (e.g., tweets [1] or foursquare checkins [16]) and other digital traces (e.g., sever logs [20]) for learning about the users' food preferences [20], cultural differences in eating and drinking habits [16] and their food consumption and related health consequences like obesity [1]. Our work differs from previous research since we are interested in exploring the role of user-generated food images for creating identity and different factors that may impact this process.

Online Identity. Traditionally, identity has been approached in terms of the relationships between the internal experience, such as personality and self-definition, and the external world, such as social relationships and shared values [5, 10]. The Internet has provided a new context for identity exploration and scholars have especially focused on how identity and language are manifested in online interactions [2, 3, 6, 7]. For example, Huffaker and Calvert [8] explore online identity and language use among male and female teenagers who maintained weblogs and conclude that teenagers stay closer to reality in their online expressions of self than has previously been suggested. To our best knowledge, this is one of the first work that explores how online identity manifests in online image sharing platforms. We focus on one specific type of images, namely food images, since food is central to all human beings and in modern society it is also used to sustain identity and differentiate social groups [4].

Gender-Specific Food Preferences. Previous research on food preferences mainly relied on surveys (people were asked what they like), observational studies (researchers observed what people choose) and lab experiments (researchers gave people similar things to eat, only changed one variable such as the amount of sugar added and asked them which meal they liked best). These methods are powerful but expensive and time consuming. These limitations, together with the fact that many factors (e.g., culture, socio-economic factors, geographic factors) might play a role in food preferences, explains why the findings in this area are partly

controversial. We believe that our approach can help to formulate new hypothesis about the impact of different factors on the people's food preferences and allows to quickly test if certain types of food or drinks are rather male, neutral or female within a given context.

5. DISCUSSION & CONCLUSION

The idea behind this research is that users create and promote their identity online by sharing content (e.g., pictures, videos or text) that exposes user's preferences in style, food or music. We presented a simple quantitative study of gender-differences in the creation of online identities in the context of food.

Since (i) the Flickr user population is constantly changing and (ii) we only analyze Flickr users who upload pictures labeled with a certain set of food-related tags, our sample is not representative of the whole population of Flickr users, neither of its sub-communities that are passionate about food pictures (and, of course, also not for the population of any country). Nevertheless, we believe that our sample might give a good indication on the gender differences in uploading food pictures online. The self-selection bias prevents us from making statistical inference for the whole group of users. However, there is no reason to believe that this bias is not consistent across genders and therefore the relative comparison of these two gender groups may still reveal interesting information.

Our results highlight interesting differences in which type of food men and women upload and show that only certain parts of them can be explained by differences in the food consumption. This is not surprising since popularity or preferences are only one factor that determines what we consume (e.g., availability, costs or health are examples of other factors). Further, popularity and preferences are clearly also impacted by the media who actively manipulate us. Our empirical analysis shows that certain parts of gender-specific food preferences which we observe in photo uploads (e.g., fish is a female food according to the media while men consume it much more) can be better explained by gender stereotypes that are promoted by the media than by actual consumption.

Although we do not think that our approach can substitute surveys about dietary preferences and food consumption, it highlights the potential of revealing which type of food is more popular among which gender and how does that changes over time and space.

Last, we remark that this work is preliminary as it is limited to the study of a single online platform. To discover whether the expression of online identity through food pictures in relation to the gender changes significantly with the type of community we plan to extend this study to additional online photo sharing services.

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